

Compact Non-contact Door Switch D40B Series

CSM_D40B_DS_E_3_1

Detects the open/closed state of doors without making contact and has high resistance to the environment.

- Detects the open/closed state of doors without making contact by combining a special magnetic Actuator and Switch. The switching mechanism is not easily disabled.
- The non-contact operation prevents the creation of particles due to abrasion.
- The Actuator and Switch can be washed with water (not immersible in water). There are no key-holes where dirt can accumulate, making it easy to keep machinery clean.
- Small distortions in the door and mechanical discrepancies can be absorbed in the allowable operating range of the magnetic Actuator and Switch.
- Safety Category 3 (EN954-1).



 Be sure to read the "Safety Precautions" on page 9 and the "Precautions for All Safety Door Switches".

Features

Special Actuators and Control Unit to Prevent False Operation

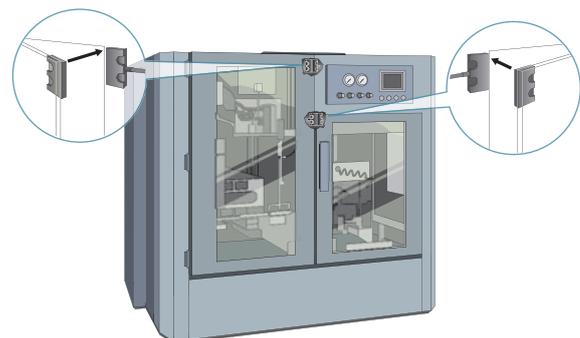
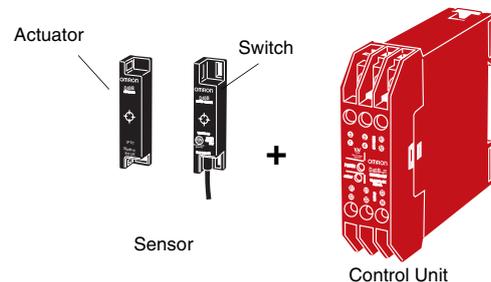
- A safety output on the Control Unit turns ON when the Special Actuator approaches.
- The safety output will not turn ON even if a magnet or magnetic body approaches.

Safety Category 3 (EN954-1)

- The Control Unit detects failures in the Sensor or connected contactor.

Detect Closed Status for Multiple Covers

- Up to six Sensors can be connected to each Control Unit.
- Cover open/closed status can be monitored by using a Sensor with an auxiliary output.



Model Number Structure

Model Number Legend

Sensor

D40B-□□□□
1 2 3 4

1. Type

- 1: Standard Sensor
- 2: Elongated Sensor
- 3: High-temperature Type Sensor

2. Auxiliary Output

- B: None
- D: 1 NC
- E: 1 NO

3. Cable Length

- 3: 3 m
- 5: 5 m
- 10: 10 m

4. Wiring Method

- None: Pre-wired
- C: Connector (Switch side only)

Controller

D40B-J□
1

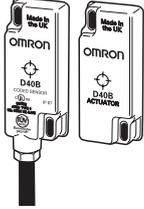
1. Type

- 1: One main contact + one auxiliary contact *
 - 2: Two main contacts + one auxiliary contact *
- * The auxiliary contacts use non-safety output.

Ordering Information

List of Models

Sensors (Switches/Actuators)

Classification	Shape	Auxiliary output	Cable length	Model
Standard Sensor		None	3 m	D40B-1B3
			10 m	D40B-1B10
		1 NC *	3 m	D40B-1D3
			10 m	D40B-1D10
Elongated Sensor		None	3 m	D40B-2B3
			10 m	D40B-2B10
		1 NC *	3 m	D40B-2D3
			10 m	D40B-2D10
High-temperature Type Sensor		1 NC *	5 m	D40B-3D5C
		1 NO *		D40B-3E5C

Note: A Sensor used in combination with a Controller is classified in Safety Category 3.

* The NC contact turns ON when the Actuator approaches the Switch and the NO contact turns ON when the Actuator separates from the Switch.

Controllers

Safety contacts	Auxiliary contacts/output *2	Rated voltage	Model
1 NO	1 NC *1	24 VAC/VDC	D40B-J1
2 NO	1 NC	24 VAC/VDC 110/230 VAC	D40B-J2

*1. MOS-FET output.

*2. Non-safety output.

Accessories

Classification	Model
Fuse	D9M-P1

Specifications

Certified Standards

- EN standards certified by TÜV Rheinland
EN954-1
EN/IEC60204-1
EN/IEC60947-5-3
- UL508, CSA C22.2 No. 14
- EN1088 conformance

Ratings and Characteristics

Sensor (Switch/Actuator)

Item	Type	Standard Sensor	Elongated Sensor	High-temperature Type Sensor
Safety contact switching distance *1		OFF→ON: 5 mm min. ON→OFF: 15 mm max.	OFF→ON: 5 mm min. ON→OFF: 18 mm max.	OFF→ON: 8 mm min. ON→OFF: 21 mm max.
Auxiliary contact switching distance *1				OFF→ON: 5 mm min. ON→OFF: 21 mm max.
Actuator approach speed *2		17 mm/s min.		
Ambient operating temperature		-10 to +55°C		-25 to +125°C
Ambient operating humidity		35% to 85%		
Degree of protection		IP67		
Material		ABS		Stainless steel
Mounting method		M4 screws		
Mounting screw tightening torque		1 N·m		
Switch auxiliary output rating *3		24 VDC, 10 mA, $\cos\phi = 1$		

*1. These values represent the distances at which OFF changes to ON (approaching) or ON changes to OFF (separating) when the Switch and Actuator's target marks are aligned and the sensing surfaces have the same orientation.

*2. If the approach speed is less than the specified value, the Controller's safety contact output may not turn ON, even if the distance is less than the switching distance.

*3. Applies only to the D40B-1D□, D40B-2D□, and D40B-3□5C. Switches with contacts have no polarity.

Controller

Ratings

Power Supply

Item	Model	D40B-J1	D40B-J2
Power supply voltage		24 VAC 50/60 Hz/24 VDC	24 VAC 50/60 Hz/24 VDC, 110 VAC 50/60 Hz, or 230 VAC 50/60 Hz
Allowable voltage range		Power supply voltage $\pm 15\%$	
Power consumption		2.0 VA max.	4.0 VA max.

Switch

Item	Model	D40B-J1	D40B-J2
Rated load	Safety contacts	250 VAC, 4 A, $\cos\phi = 1$ 30 VDC, 2 A, $\cos\phi = 1$	
	Auxiliary contacts/output *	230 VAC, 100 mA, $\cos\phi = 1$ 24 VDC, 100 mA, $\cos\phi = 1$	250 VAC, 4 A, $\cos\phi = 1$ 30 VDC, 2 A, $\cos\phi = 1$

* D40B-J1: MOS-FET output; D40B-J2: Contact output.

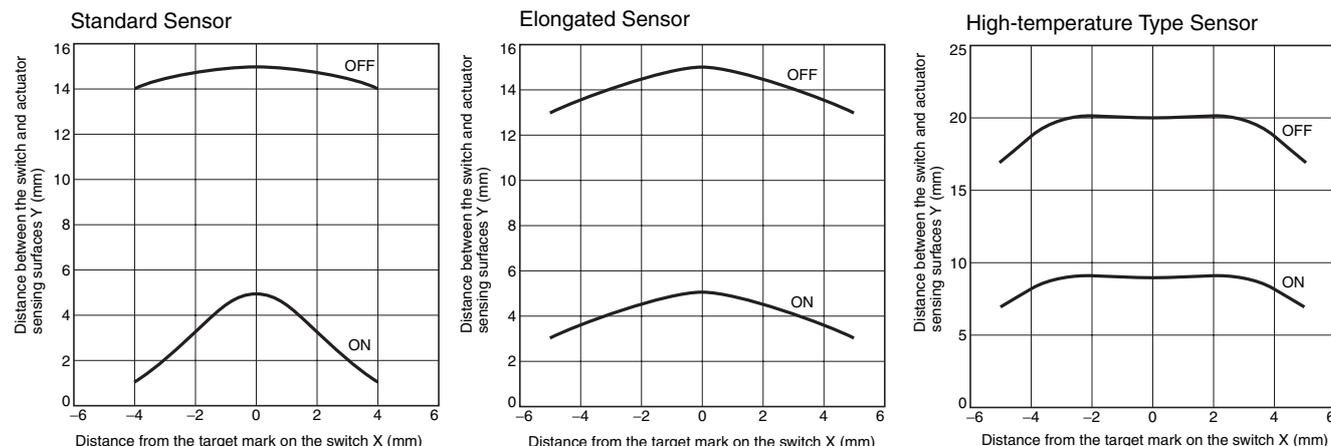
Characteristics

Item	Model	D40B-J1	D40B-J2
Contact resistance		100 mΩ max. (not including auxiliary output)	100 mΩ max. (including auxiliary output)
Auxiliary output ON resistance		36 Ω (nominal value)	---
Response time		25 ms max.	
Insulation resistance *		100 MΩ min. (at 500 VDC)	
Dielectric strength	Between output poles	1,500 VAC 1 min.	
	Between inputs and outputs		
	Between power supply and outputs		
Vibration resistance		10 to 55 to 10 Hz, 1 mm single amplitude (double amplitude: 2 mm), IEC68-2-6	
Shock resistance		300 m/s ²	
Durability	Mechanical	1,000,000 operations min.	
	Electrical	100,000 operation min. (at the rated load)	
Minimum rated current for safety contacts		10 VAC/VDC, 10 mA (reference values)	
Ambient operating temperature		-10 to +55°C	
Ambient operating humidity		90% at +50°C	
Mounting method		35 mm DIN Track (Screw mounting is not possible.)	
Terminal screw tightening torque		1 N·m	
Weight		147 g	590 g

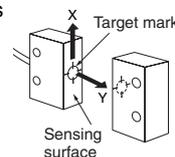
* The measurement locations are the same as for the dielectric strength.

Engineering Data

Detection Ranges

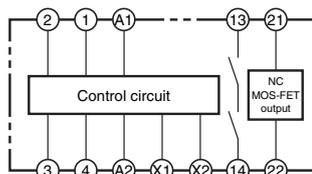


Note: The graph contains typical data collected in a standard testing environment. These figures are not guaranteed operating values. The actual operation distance may vary due to the effects of nearby metals, magnetic materials, and ambient temperature.

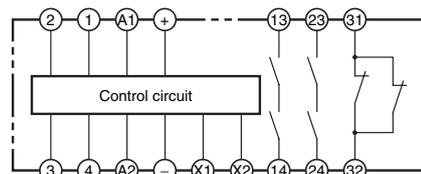


Internal Connection Diagram

D40B-J1



D40B-J2



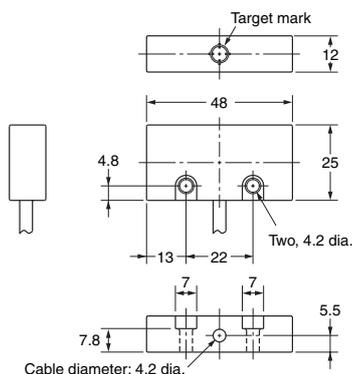
- Note: 1.** If a 100/230 VAC power supply is used, connect it to the A1 and A2 terminals. Do not connect the power supply to the + and - terminals.
- 2.** If a 24 VDC power supply is used, connect it to the + and - terminals. Do not connect the power supply to the A1 and A2 terminals.

Dimensions and Terminal Arrangement

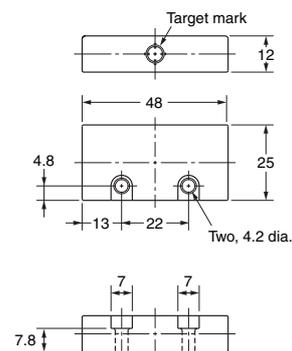
Sensor (Switch/Actuator)

Standard Sensor

- D40B-1B3
- D40B-1B10
- D40B-1D3
- D40B-1D10



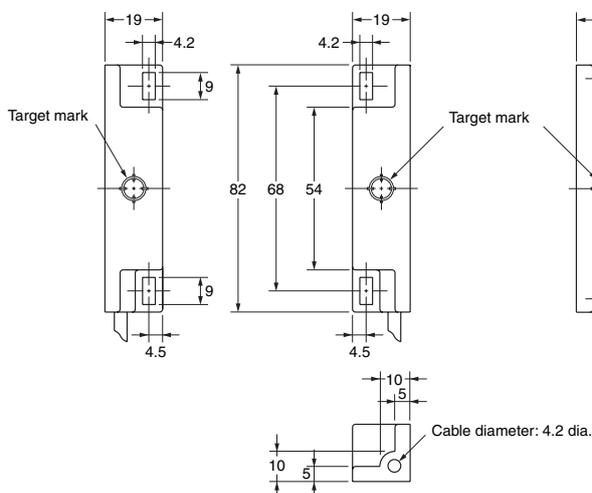
(Switch)



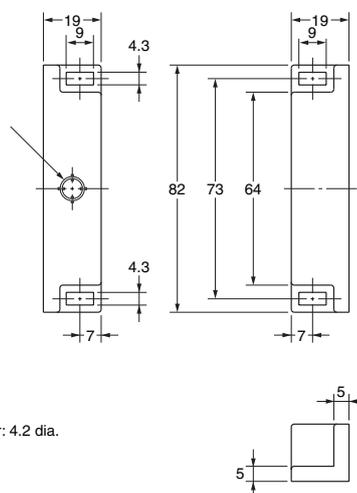
(Actuator)

Elongated Sensor

- D40B-2B3
- D40B-2B10
- D40B-2D3
- D40B-2D10



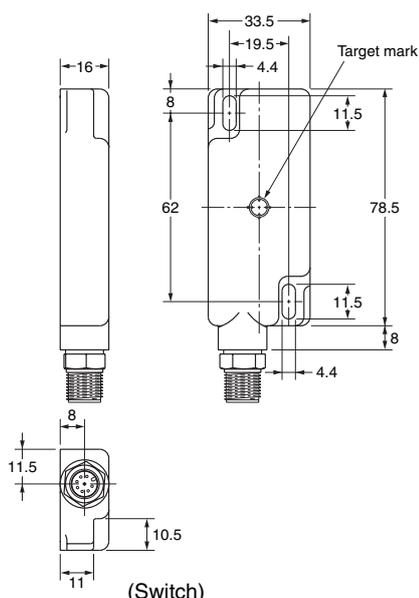
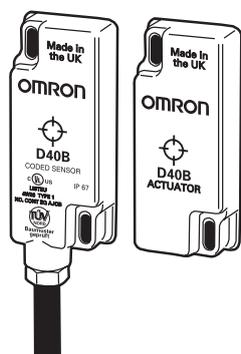
(Switch)



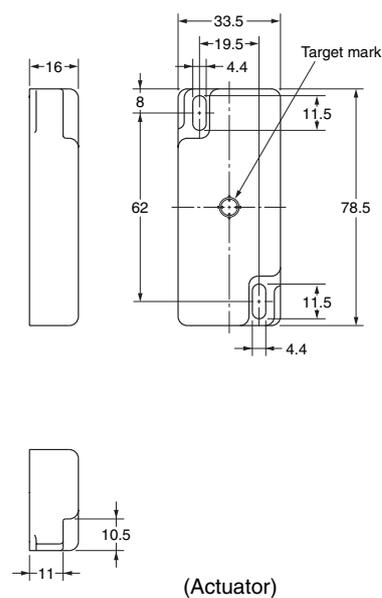
(Actuator)

High-temperature Type Sensor

- D40B-3D5C
- D40B-3E5C



(Switch)

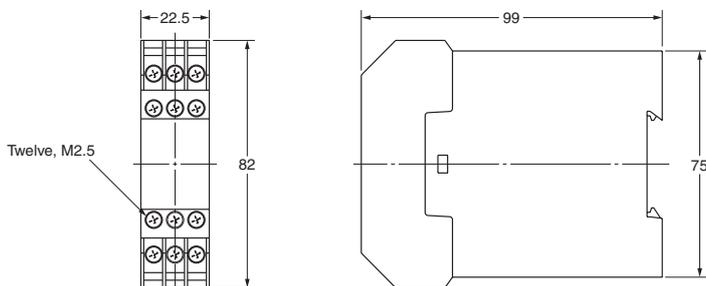
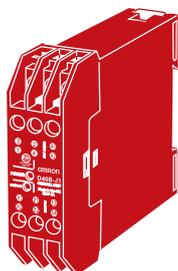


(Actuator)

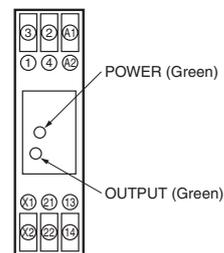
Controller

1-Pole Controller

D40B-J1

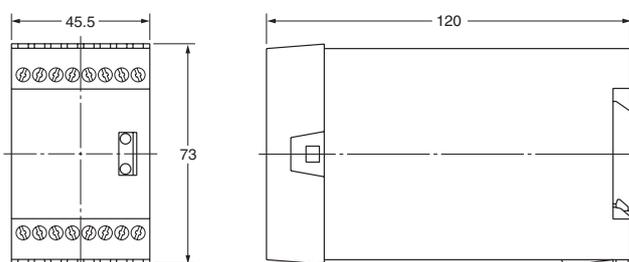


Terminal Arrangement

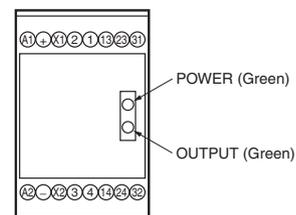


2-Pole Controller

D40B-J2



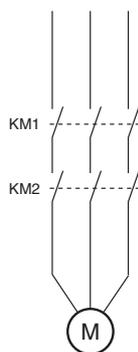
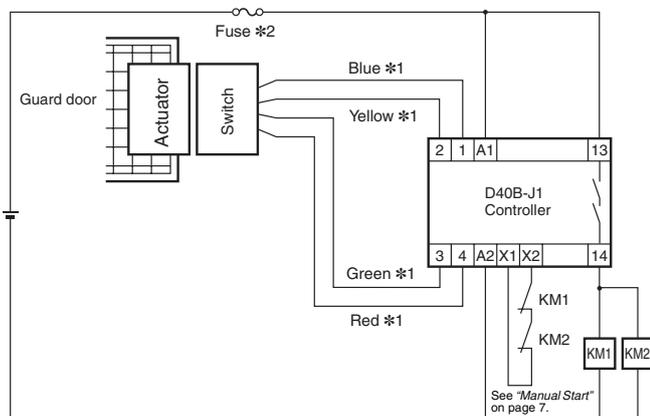
Terminal Arrangement



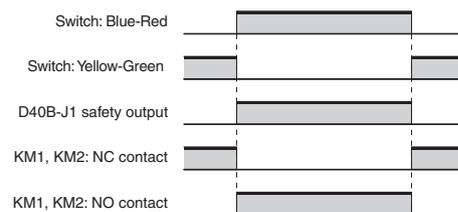
Application Examples

Wiring Example for 1 Sensor and 2 Contactors (with D40B-J1): Auto-reset

The configuration in this example is for auto-reset and contactor monitoring.



Timing Chart



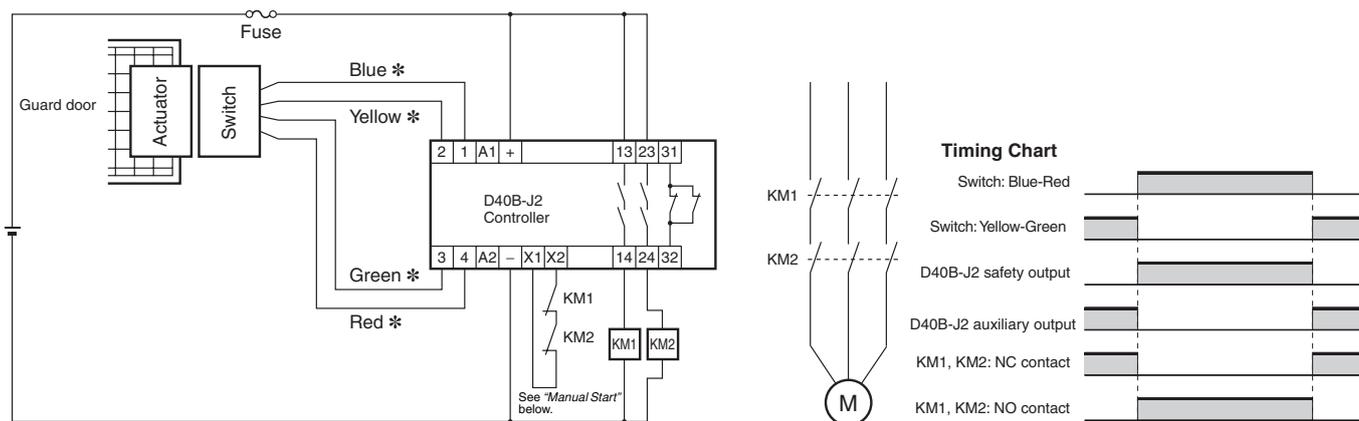
Note: The circuit in this example is equivalent to a Safety Category 3 circuit.

*1. This example applies to Standard or Elongated Sensors. The wire colors for the High-temperature Type Sensors are different. Refer to "Sensor and Controller Connection Examples" on page 8.

*2. Always use a fuse to protect the power supply from ground faults.

Wiring Example for 1 Sensor and 2 Contactors (with D40B-J2): Auto-reset

The configuration in this example is for auto-reset and contactor monitoring.

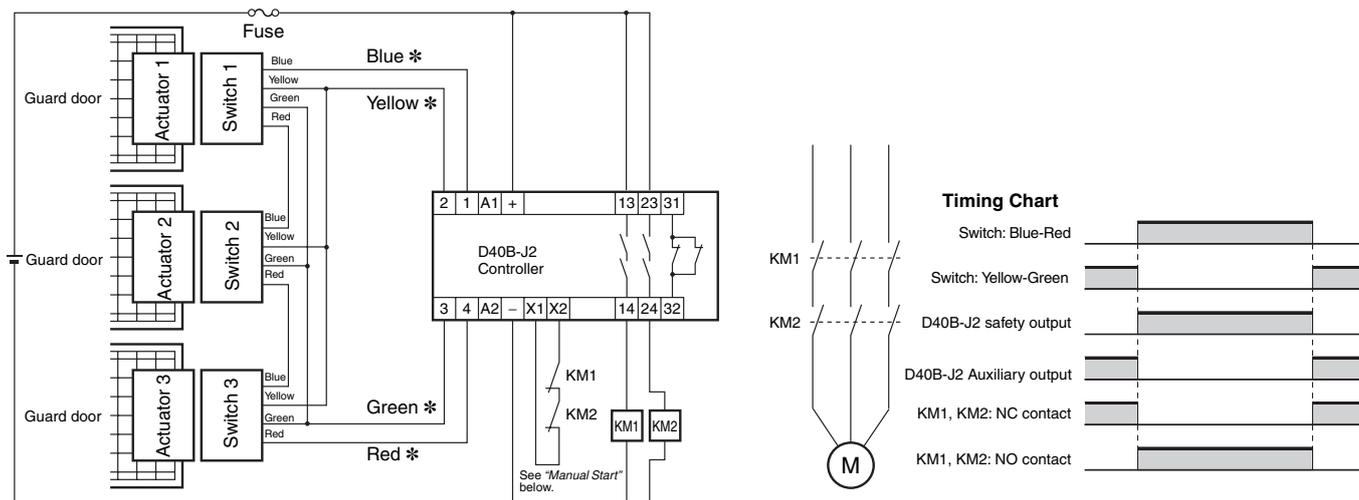


Note: The circuit in this example is equivalent to a Safety Category 3 circuit.

* This example applies to Standard or Elongated Sensors. The wire colors for the High-temperature Type Sensors are different. Refer to "Sensor and Controller Connection Examples" on page 8.

Wiring Example for 3 Sensors and 2 Contactors (with D40B-J2): Auto-reset

The configuration in this example is for auto-reset and contactor monitoring.



Note: 1. The circuit in this example is equivalent to a Safety Category 3 circuit.

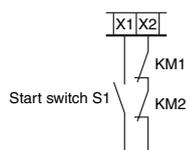
2. If two or more Sensors are connected to one Controller, all of the guard doors must open and close independently. If two or more doors open and close at the same time, it is possible that a fault of the Sensors may not be detected.

3. Up to six Sensors can be connected to a single Controller.

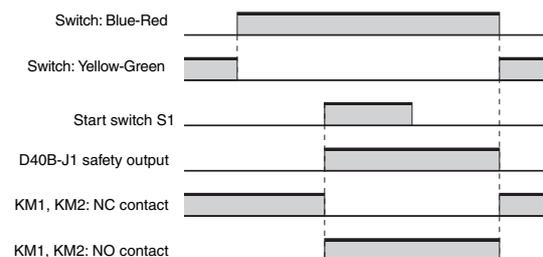
* This example applies to Standard or Elongated Sensors. The wire colors for the High-temperature Type Sensors are different. Refer to "Sensor and Controller Connection Examples" on page 8.

Manual Start

If manual start is required, insert start switch S1 between X1 and X2 as shown below. Monitored start is not possible.

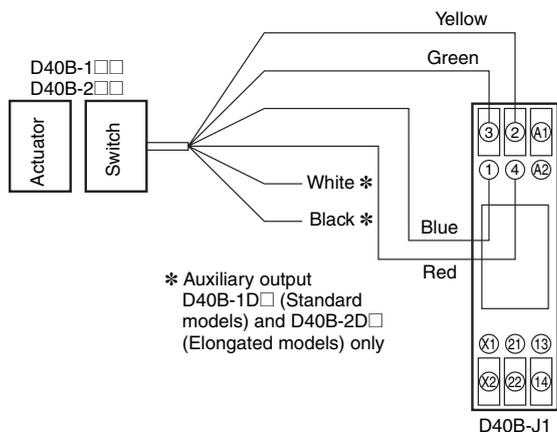


Timing Chart

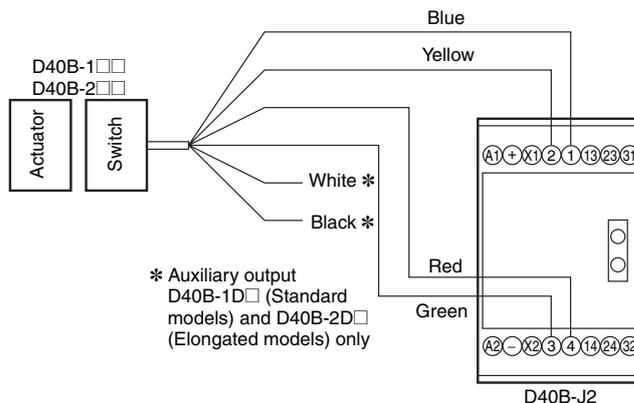


Sensor and Controller Connection Examples

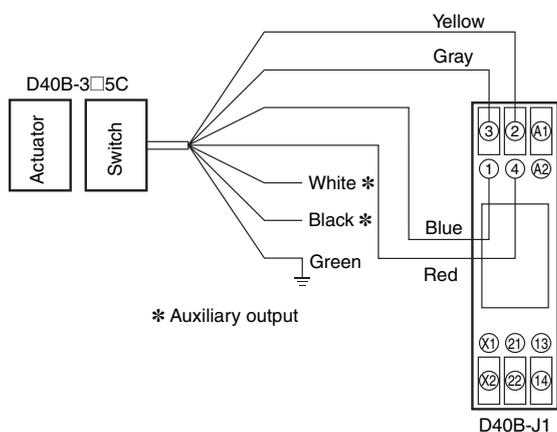
Connection between Standard or Elongated Sensor and 1-pole Controller



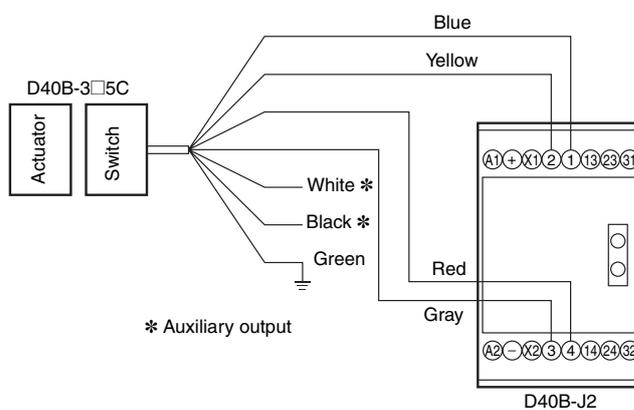
Connection between Standard or Elongated Sensor and 2-pole Controller



Connection between High-temperature Type Sensor and 1-pole Controller



Connection between High-temperature Type Sensor and 2-pole Controller



Safety Precautions

Refer to the “*Precautions for All Switches*” and “*Precautions for All Safety Door Switches*”.

WARNING

Serious injury may possibly occur due to breakdown of safety outputs.
Do not connect loads beyond the rated value to the safety outputs.



Serious injury may possibly occur due to loss of required safety functions.

Wire D40B properly so that supply voltages or voltages for loads do NOT touch the safety inputs accidentally or unintentionally.



CAUTION

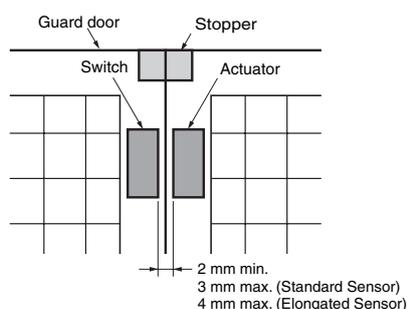
Be sure to turn OFF the power before performing wiring. Do not touch charged parts (e.g., terminals) while power is ON. Doing so may result in electric shock.



Do not allow the Actuator to come close to the Switch with the door open. Doing so may cause machinery to start operating and may result in injury.



Use stoppers in the way shown below to ensure that the Switch and Actuator do not make contact when the guard door is closed.



Precautions for Safe Use

- Do not use the product in locations subject to explosive or flammable gases.
- Do not use load currents exceeding the rated value.
- Be sure to wire each conductor correctly.
- Be sure to confirm correct operation after completing mounting and adjustment.
- Do not drop or attempt to disassemble the product.
- Be sure to use the correct combination of Switch and Actuator.
- Do not mount the Switch and Actuator on magnetic materials, otherwise it may affect the operating distance.
- Use a power supply of the specified voltage. Do not use power supplies with large ripples or power supplies that intermittently generate incorrect voltages.
- Capacitors are consumable and require regular maintenance and inspection.
- Do not touch any of the terminals while the power is being supplied. Doing so may result in electric shock.
- Do not attempt to take any Unit apart while the power is being supplied. Doing so may result in electric shock.
- Do not allow metal fragments or lead wire scraps to fall inside this product. These may cause electric shock, fire, or malfunction.
- Be sure to turn OFF the power before performing wiring. Not doing so may result in electric shock.
- Apply the specified voltage to input terminals. Applying a different voltage may prevent proper operation and may result in product damage or burning.
- Do not under any circumstances, use the product for loads that exceed the product's contact ratings, such as the switching capacity (switching voltage and switching current). Doing so may not only result in faulty insulation, contact deposition, contact failure, or other problems affecting product performance, it may also result in damage or burning.
- Do not drop the product or use components that have been disassembled. Doing so may not only adversely affect performance characteristics, it may also result in damage.
- Ensure that solvents, such as alcohol, thinner, trichloroethane, or gasoline do not come into contact with the product. Solvents may cause markings to fade and components to deteriorate.

Precautions for Correct Use

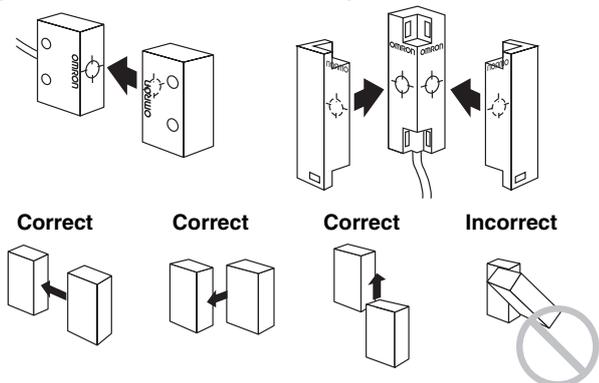
Description

1. The D40B-series Sensor (switch and actuator) must only be used with the D40B-series Controller.
2. The D40B-series guard interlock switch system is self monitoring and comprises a magnetic actuator and switch connected via two wiring channels to a Controller.

Mounting Direction of Switch and Actuator

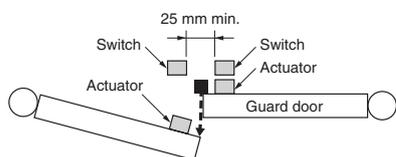
The Sensor will not operate properly if the Switch and Actuator approach each other diagonally. The Sensor will operate correctly when the Switch and Actuator approach each other directly (face to face), horizontally, or vertically.

Also, as shown in the following figures, use the D40B-1□ with the OMRON logos appearing on the same sides of the Switch and Actuator, and use the D40B-2□ and D40B-3□ with the OMRON logos on the Switch and Actuator facing each other.



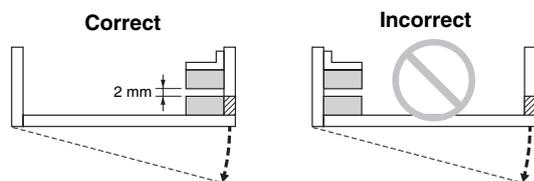
Mutual Interference

If the Switch and Actuator are mounted in parallel, be sure to separate them by at least 25 mm, as shown below.



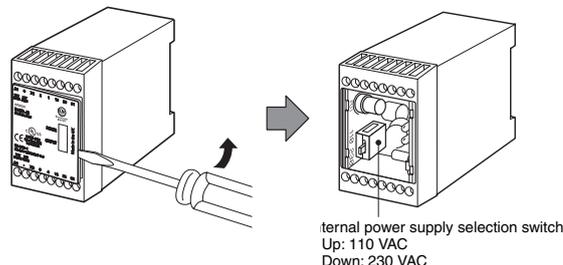
Using for Hinged Doors

On hinged doors, install the Sensor at an opening edge as shown below.



Switching Power Supply Voltage (D40B-J2 Only)

- Turn OFF the power to the Controller.
- Open the Controller's front cover with a flat-bladed screwdriver.
- Change the power supply voltage as required with the internal power supply selection switch. The switch is factory-set to 230 VAC.

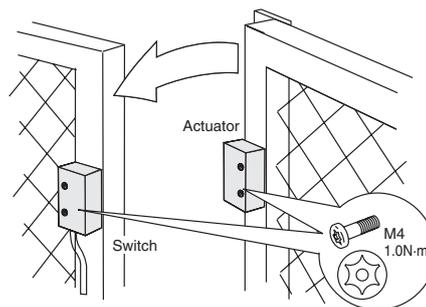


Mounting the Switch and Actuator

Whenever possible, mount the Switch and Actuator to nonferrous materials. The operating distance will be affected if they are mounted to ferrous materials. When mounting the Switch and Actuator, separate them by at least 2 mm.

Standard Sensors

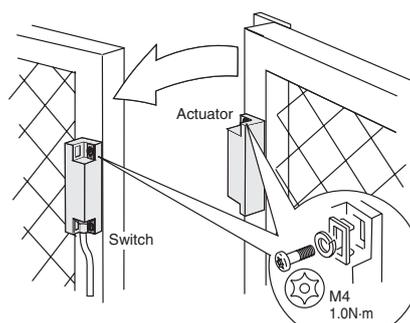
D40B-1□□



Always use a Standard Actuator with a Standard Switch.

Elongated Sensors

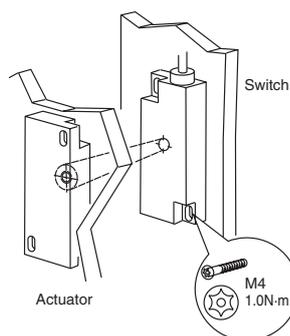
D40B-1□□



Always use an Elongated Actuator with an Elongated Switch.

High-temperature Sensors

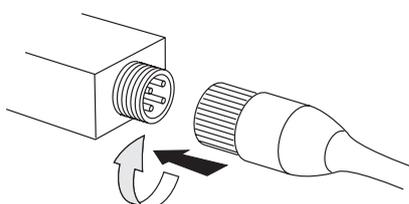
D40B-3□5C



Always use a High-temperature Actuator with a High-temperature Switch.

Note: Using anaerobic locking compounds can have a detrimental effect on the plastic switch case if the compounds come into contact with the switch case.

High-temperature Sensor Connectors

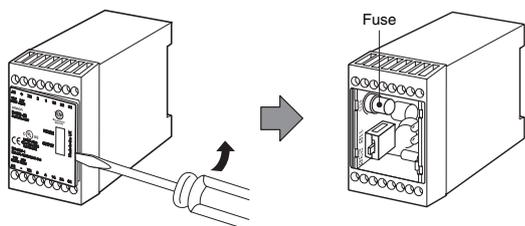


Installation Instructions

1. Installation must be in accordance with the following steps and must be carried out by suitably competent personnel.
2. This device is intended to be part of the safety related control system of a machine. Before installation, a risk assessment should be performed to determine whether the specifications of this device are suitable for all foreseeable operational and environmental characteristics of the machine to which it is to be fitted.
3. At regular intervals during the life of the machine check whether the characteristics foreseen remain valid and inspect this device for evidence of accelerated wear, material degradation or tampering. If necessary the device should be replaced.
4. OMRON cannot accept responsibility for a failure of this device if the procedures given in this sheet are not implemented or if it is used outside the recommended specifications in this sheet.
5. Guard stops and guides must be fitted to protect the D40B-series Sensor from shock.

Fuse Replacement Method (D40B-J2 Only)

- Turn OFF the power to the Controller.
- Open the Controller's front cover with a flat-bladed screwdriver.
- Replace the fuse (D9M-P1).



Note: Fuse replacement is not required for the D40B-J1 because it contains a self-resetting fuse.

Applicable Safety Category (EN954-1)

This product can be used in environments classified as Safety Category 3 according to the requirements of European standard EN954-1. This evaluation, however, is based on circuit configuration examples proposed by OMRON. The standard may not apply in some operating conditions.

The applicable safety category is determined from the whole safety control system. Make sure that the whole safety control system meets EN954-1 requirements.

Installation Location

- Do not install the product in the following locations. Doing so may result in product failure or malfunction.
 - Locations subject to direct sunlight
 - Locations subject to temperatures outside the range -25 to 55°C
 - Locations subject to humidity levels outside the range 35% to 85% or subject to condensation due to extreme temperature changes
 - Locations subject to corrosive or flammable gases
 - Locations subject to shock or vibration in excess of the product ratings
 - Locations subject to exposure to water, oil, or chemicals
 - Locations subject to dust (including iron dust) or salts
- Take appropriate and sufficient countermeasures when using the product in the following locations.
 - Locations subject to static electricity or other forms of noise
 - Locations subject to possible exposure to radioactivity
 - Locations close to power supply lines

Wiring

- Perform wiring using wires with the following dimensions.
 - Stranded wires: 0.2 to 2.5 mm^2
 - Solid wire: 0.2 to 4.0 mm^2
- Tighten the terminal screws with the specified torque. Not doing so may result in malfunction or abnormal heat generation.
 - Terminal screw tightening torque: $1\text{ N}\cdot\text{m}$ max.

Safety Functions

Adherence to the recommended inspection and maintenance instructions forms part of the warranty. When a single Sensor is connected to the Controller a single safety related fault at the Sensor, connecting wiring or inside the Controller will be detected either immediately or at the next opening of the guard (depending on the type of fault). When the fault is detected the Controller goes to a lock out condition. The output contacts will not close until the fault has been rectified. If multiple Sensors are connected to the Controller each guard door should be opened and then shut individually. Otherwise some single faults may not be detected and unintentional lockout reset may occur if two or more guard doors are open at the same time.

Read and Understand This Catalog

Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this catalog.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA

Performance data given in this catalog is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS

The information in this document has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

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In the interest of product improvement, specifications are subject to change without notice.

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